Quantum Digital USB Flash Disk Module

General Description and Key Features

Quantum Digital's USB Flask Disk Module (UFDM) provides non-volatile, solid-state storage in a compact design, making it perfectly suited for embedded applications. The standard USB 2.0 interface provides designers with a true plug-n-play storage device, allowing for short design cycles and fast time to market.

Quantum Digital selects the highest reliability Single Level Cell (SLC) Flash for its superior endurance. The flash management software that is embedded in the controller emulates a hard disk, enabling read/write operations that are identical to a standard, sector-based hard disk. Sophisticated wear leveling algorithms guarantee 2,000,000 Write/Erase Cycles, while automatic bad block management and a built-in ECC Engine guarantee the highest data reliability. Based on the Reed-Solomon algorithm, the ECC engine can detect up to 5-byte errors and correct up to 4-byte errors per 512 blocks.

USB Flash Disk Module is available in standard and low profile horizontal type with fixed hole, standard 10 pins 2.54mm pin pitch USB female connector or low profile
10 pins 2.0mm pin pitch USB female connector, specifically suited for designs that have Z-height constraints. High performance, high reliability and low cost per MByte make the USB Flash Disk Module the product of choice in embedded applications, such as Gaming, POS Workstations, Networking Equipment and Industrial PCs.

Quantum Digital offers value-added services to OEM customers, such as customized form factors and test solutions, custom firmware, controlled Bill Of Materials, customer-specific labeling and serialization.

USB Solid - State Flash Disk

Capacity: 128 MB - 8 GB

USB 2.0 and 1.1 backward Compatible

Form Factors:

- Horizontal
- Low Profile

High Reliability:

- Endurance Guarantee of 2,000,000 Write/ Erase Cycles
- Dynamic Wear-leveling
- 5-Byte Detection, 4-Byte Correction ECC Engine
- Automatic Bad Block Management
- Single Level Cell (SLC) NAND Flash Memory
- 10 Year Data Retention

Unique Serial Number

Commercial and Industrial Operating Temperature

RoHS-6 Compliant

Industrial 5-year Warranty

Standard 3-year Warranty

Ordering Information: USB Flash Disk Module

Ordering Information:

Part Number	PC Card Form Factor	Capacity
QDUFDM-128MUU1(I)-y	y=A, B	128 Mbytes
QDUFDM-256MUU1(I)-y	y=A, B	256 Mbytes
QDUFDM-512MUU1(I)-y	y=A, B	512 Mbytes
QDUFDM-1GUU1(I)-y	y=A, B	1 Gbytes
QDUFDM-2GUU1(I)-y	y=A, B	2 Gbytes
QDUFDM-4GUU1(I)-y	y=A, B	4 Gbytes
QDUFDM-8GUU1(I)-y	y=A, B	8 Gbytes

QDUFDM= QDT standard USB Flask Disk Module part number prefix.

(M/G) = proceeding capacity (xxx) is in Megabytes (M) or Gigabytes (G).

U = RoHS-6 compliant lead-free.

Part numbers without (I) = Commercial temperature range (0ºC to 70ºC).

(I) = Industrial temperature range (-40ºC to +85 ºC).

(y) = A for Horizontal

(y) = B for Low Profile

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Revision History

Rev.	*Description*	*Update*
1.0	*Preliminary version*	*2010/06/11*
1.1	*Part number correction (page 15)*	*2010/07/31*
1.2	*Add 16GB Capacity for Horizontal Type*	*2010/06/26*
1.3	*Update the Temperature of Operating & Non-operating*	*2010/07/19*
1.4	*Remove 16GB Capacity for Horizontal Type*	*2010/10/21*

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1. Introduction

QDT's Industrial micro USB (Flash Disk) Module - MUM, is specified as 2.0 High Speed Device, Mass Storage Class, USB-IF, WHQL and EMI tests certified. The MUM Flash Disk supports optional standard operating temperature 0°C ~ +70 °C and wide operating temperature -40°C ~ +85°C , is designed to meet the special demand of USB Flash Disks which replace the traditional floppy disks as the removable mass storage solution for certain harsh Industrial applications which needs larger storages but limited space. The MUM flash disk operates like a hard drive, but has the speed and Transportability of a solid statedevice.

QDT's Industrial micro USB flash disk module (MUM) is an internal solution that attaches direct to a USB pin connector on motherboard. Coming in capacities of 128MB~8GB for horizontal type and 128MB~4GB for Vertical type, it improves the form-factor diversity and increase solutions of storage choosing: There are 2 types with three form-factor for QDT industrial micro USB flash disk module (MUM) for industrial embedded computing, including 2x5 2.54mm pitch pin connector horizontal type without casing, 2x5 2.00mm horizontal type without casing and also 2x5 2.54mm pitch pin connector vertical type with casing.

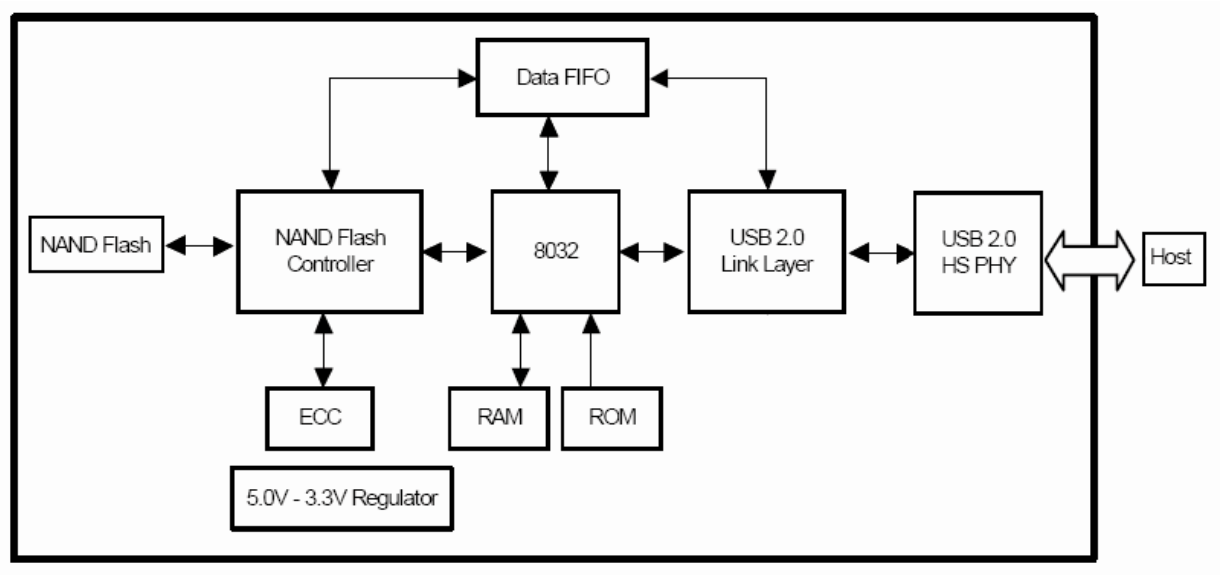

Figure 1: Industrial USB (Flash Disk) Module Block Diagram

1.1. *Scope*

This document describes the key features and specifications of Industrial USB (Flash Disk) Model (MUM)

1.2. *System Features*

- 2x5 header, x86 internal USB standard
- Horizontal - 2 form-factors : 2x5 2.54mm connector & 2.00mm pitch pin connector
- Vertical- 1 form-factor : 2x5 2.54mm pitch pin connector
- Complies with Microsoft Vista Ready-Boost® requirements
- Fixed disk type (not removable)
- Advanced error detection and error correction algorithms
- High-speed USB 2.0 interface; backward compatible with USB 1.1
- Horizontal: Capacities from 128MB up to 8GB
- Vertical: Capacities from 128MB up to 4GB
- Performance up to 32.0MB/sec max.

2. Product Specifications

For all the following specifications, values are defined at ambient temperature and nominal supply voltage unless otherwise stated.

2.1. System Environmental Specifications

Table 1: Environmental Specification

Industrial micro USB Module (MUM) – DEMETER Series		Commercial Grade	Industrial Grade
Temperature	Operating: Non-operating:	0°C ~ +70°C -20ºC ~ +80ºC	-40°C ~ +85°C -50ºC ~ +95ºC
Humidity	Operating & Non-operating:	10% ~ 95% non-condensing	
Vibration	Operating & Non-operating:	16.3G peak-to-peak maximum	
Shock	Operating & Non-operating:	1,500 G maximum	

2.2. System Power Requirements

Table 2: Power Requirement

DC Input Voltage (VCC) 100mV max. ripple(p-p)		Vertical (4GB)	Horizontal (8GB)
+5V Current (Maximum average value)	Idle Mode :	39 mA (Max.)	43 mA (Max.)
	Reading Mode :	113 mA (Max.)	114 mA (Max.)
	Writing Mode :	89 mA (Max.)	94 mA (Max.)

2.3. System Performance

Table 3: System Performances

Performance (KB/sec)	Sequent Speed (MB/Sec.)			
	Single Channel		Dual Channel	
	Read	Write	Read	Write
128MB	26.1	12.3	N/A	N/A
256MB	26.4	12.6	32.3	16.5
512MB	26.3	12.7	32.2	16.2
1GB	26.2	12.3	32.1	16.6
2GB	26.5	12.0	32.2	16.7
4GB	26.5	12.1	32.7	16.9
8GB	N/A	N/A	32.7	16.9

Note:

(1). All values quoted are typically at 25℃ and nominal supply voltage.

(2). The Max. Performance was tested by SiSoftware Sandra /File Benchmark

2.4. *System Reliability*

Table 4: System Reliability

MTBF	>3,000,000 hours
Wear-leveling Algorithms	Dynamic
ECC Technology	Enhanced management 8 bits per 512bytes block
Endurance	Greater than 2,000,000 cycles Logically contributed by Wear-leveling and advanced bad sector management
Data Retention	10 years

2.5. *Physical Specifications*

Refer to Table 5 and see Figure 3 for USB Flash Disk physical specifications and dimensions.

Table 5: Physical Specifications

QDT Industrial USB Disk Module Horizontal Type – Standard Form factor (2.54mm pitch pin)	
Length:	37.85 mm
Width:	26.75 mm
Thickness:	9.0 mm
Weight:	10.0 g / 0.35 oz.
Available Capacity:	128MB, 256MB, 512MB, 1GB, 2GB, 4GB and 8GB

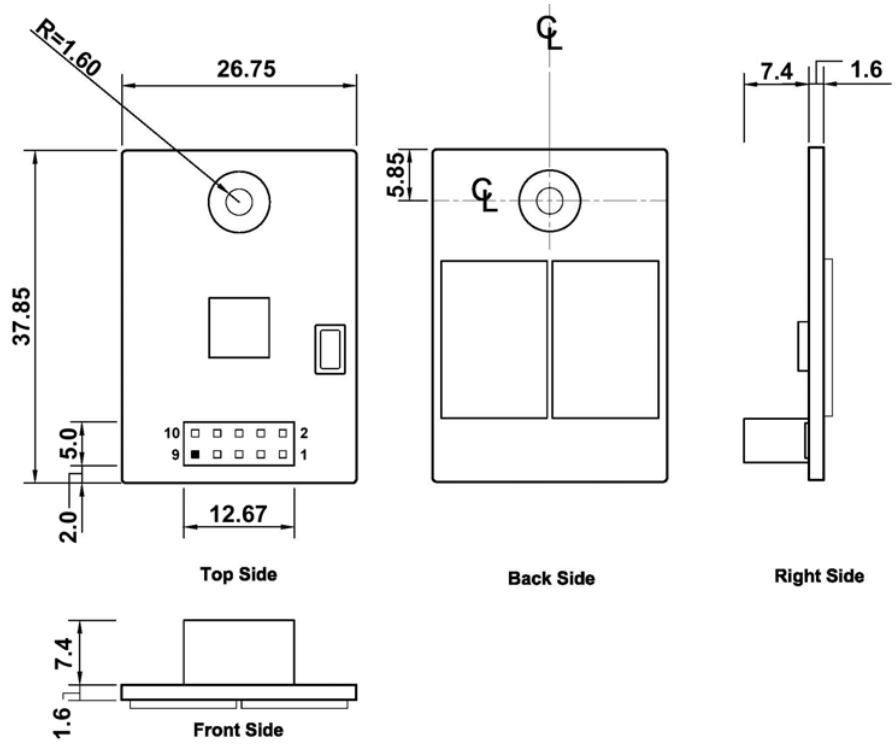

Figure 2: Industrial USB Disk Module Horizontal Type – Standard Form factor Dimension

QDT Industrial USB Disk Module Horizontal Type – Low profile Form factor (2.00mm pitch pin)	
Length:	37.85 mm
Width:	26.75 mm
Thickness:	5.90 mm
Weight:	10.0 g / 0.35 oz.
Available Capacity:	128MB, 256MB, 512MB, 1GB, 2GB, 4GB and 8GB

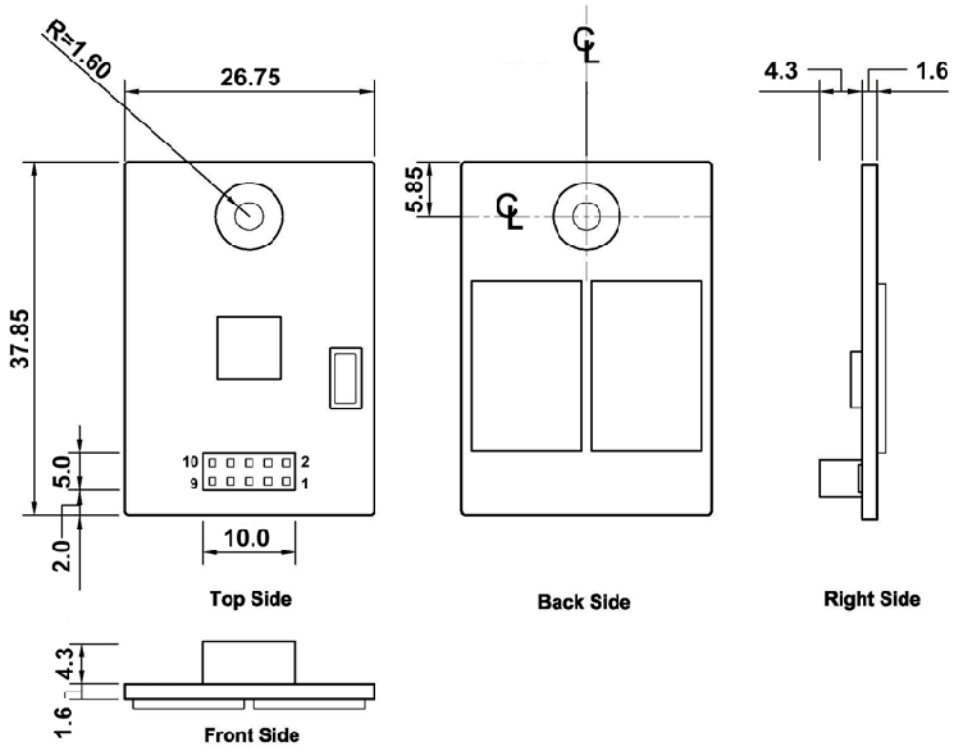

Figure 3: Industrial USB Disk Module Horizontal Type – Low Profile Form factor Dimension

QDT Industrial USB Disk Module Vertical Type Form factor (2.54mm pitch pin)	
Length:	34.20 mm
Width:	15.40 mm
Thickness:	6.30 mm
Weight:	15.0 g / 0.53 oz.
Available Capacity:	128MB, 256MB, 512MB, 1GB, 2GB and 4GB

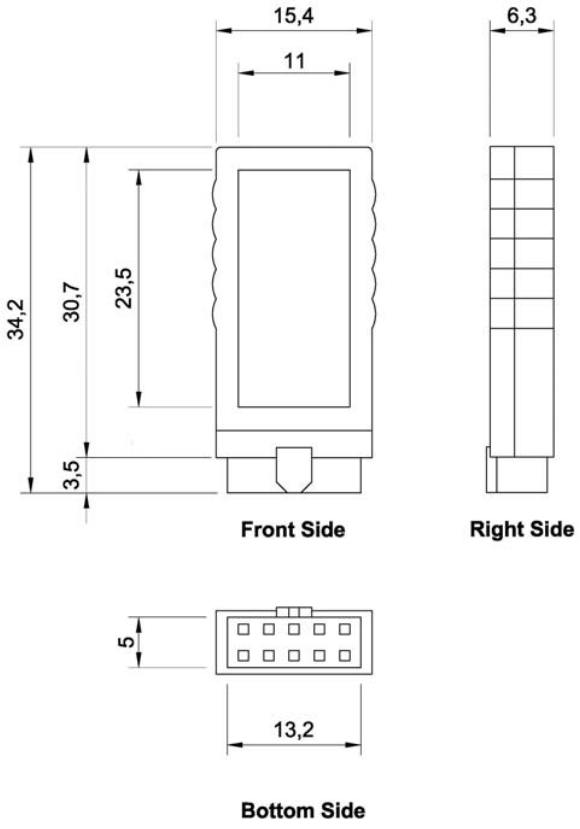

Figure 3: Industrial USB Disk Module Vertical Type Form factor Dimension

2.6. *Capacity Specifications*

Industrial micro USB Flash Disk Module (MUM) USB 2.0 Flash Disks are built-in mainly Samsung NAND Type SLC Flash memory chips. The Table 6 shows the equipollent part number of applied Samsung Flash memory chips for each USB Flash Disk.

Table 6: USB Flash Disk Configuration vs. Samsung NAND SLC part number

Capacity	Samsung SLC Flash Memory Part Number * Q'TY	
	Vertical Type	Horizontal Type
128MB	K9F1G08U0A (1Gb) or equal * 1	K9F1G08U0A (1Gb) or equal * 1
256MB	K9F2G08U0A (2Gb) or equal * 1	K9F2G08U0A (2Gb) or equal * 1
512MB	K9F4G08U0M (4Gb) or equal * 1	K9F4G08U0M (4Gb) or equal * 1
1GB	K9K8G08U0M (8Gb) or equal * 1	K9K8G08U0M (8Gb) or equal * 1
2GB	K9WAG08U1M (16Gb) or equal *1	K9WAG08U1M (16Gb) or equal *1 K9K8G08U0M (8Gb) or equal * 2
4GB	K9WBG08U1M (32Gb) or equal *1	K9WBG08U1M (32Gb) or equal *1 K9WAG08U1M (16Gb) or equal *2
8GB	Not support 2 flashes	K9WBG08U1M (32Gb) or equal *2

3. Interface Description

3.1. Physical Description

The host is connected to the Industrial micro USB Flash Disk Module (MUM) using a Type A female USB connector.

3.2. Pin Assignments

Table 8 Pin Assignments of USB 2.0

Horizontal Type			
Pin Number	**Signal**	**Pin Number**	**Signal**
Pin 1	+5VDC	**Pin 2**	NC
Pin 3	USB -	**Pin 4**	NC
Pin 5	USB +	**Pin 6**	NC
Pin 7	GND	**Pin 8**	NC
Pin 9	NC	**Pin 10**	NC

4. Electrical Characteristics

4.1. Absolute Maximum Ratings

Table 9 Absolute Maximum Ratings

SYMBOL	PARAMETER	RAITING	UNITS
V_{CC33}	3.3V supply voltage	-0.3 to 3.6	V
V_{CC18}	1.8V supply voltage	-0.3 to 2	V
V_{IN33}	3.3V buffer input voltage	-0.3 to 3.6	V
V_{IN335}	3.3V/5V buffer input voltage	-0.3 to 5.5	V
V_{IN18}	1.8V buffer input voltage	-0.3 to 2	V
T_{STG}	Storage Temperature	Standard grade : -20 ~ +80 Industrial grade : -50 to +95	℃
T_a	Operating Temperature	Standard grade : 0 ~ 70 Industrial grade : -40 ~ +85	℃

4.2. Recommended Operating conditions

Table 10 Recommended Operating Conditions

SYMBOL	PARAMETER	MIN	TYPE	MAX	UNITS
USB_{Vin}	5V Power Supply	3.2	5.0	5.5	V
V_{DD33}	3.3V Power Supply	3.0	3.3	3.6	V
V_{DD18}	1.8V Power Supply	1.6	1.8	2	V

4.3. General DC Characteristics

Table 11 DC CHARACTERISTICS OF I/O INTERFACE

Symbol	Parameter	Min	Max	Unit	Notes
V_{IH_TTL}	TTL Input High Voltage	2	Vcc3+0.3	V	1
V_{IL_TTL}	TTL Input Low Voltage	-0.3	0.8	V	1
V_{OH_TTL}	TTL Output High Voltage	0.9Vcc3		V	1
V_{OL_TTL}	TTL Output Low Voltage		0.45	V	1
I_{OH_TTL}	TTL Output High Current	-4		mA	1
I_{OL_TTL}	TTL Output Low Current		4	mA	1
V_{IH_USB}	USB Input High Voltage for Low-/full-speed	2.0		V	2
V_{IL_USB}	USB Input Low Voltage for Low-/full-speed		0.8	V	2
$V_{I_USB_DIFF}$	Differential Input Sensitivity for Low-/full-speed	TBD		V	2

$V_{I_USB_CM}$	Differential Common Mode Input Range for Low-/full-speed	0.8	2.5	V	2
$V_{I_USB_HSSQ}$	USB High-speed squelch Input detection threshold	0.1	0.15	V	2
$V_{I_USB_HSDSC}$	USB High-speed disconnect Input detection threshold	0.525	0.625	V	2
$V_{I_USB_HSCM}$	USB High-speed Signaling Common Mode Range	-0.05	0.5	V	2
V_{OH_USB}	USB Output High Voltage for Low-/full-speed	2.8	3.6	V	2
V_{OL_USB}	USB Output Low Voltage for Low-/full-speed	0	0.3	V	2
$V_{OH_USB_HS}$	USB Output High Voltage for High-speed	0.36	0.44	V	2
$V_{OL_USB_HS}$	USB Output Low Voltage for High-speed	-0.01	0.01	V	2
I_{OH_USB}	USB Output High Current for Low-/full-speed	-10		mA	2
I_{OL_USB}	USB Output Low Current for Low-/full-speed		10	mA	2
$I_{OH_USB_HS}$	USB Output High Current for High-speed	-40		mA	2
$I_{OL_USB_HS}$	USB Output Low Current for High-speed		40	mA	2

General AC Characteristics

Table 12 AC CHARACTERISTICS OF I/O INTERFACE

Symbol	Parameter	Min.	Typ.	Max.	Unit
TP_{ILH}	Input Rising Delay	0.61 (0.8pF)	0.72 (2.4pF)	0.92 (4.8pF)	ns
TP_{IHL}	Input falling Delay	0.88 (0.8pF)	1.03 (2.4pF)	1.24 (4.8pF)	ns
TP_{OLH}	Output Rising Delay	2.40 (10pF)	3.42 (30pF)	4.88 (60pF)	ns
TP_{OHL}	Output falling Delay	2.61 (10pF)	3.62 (30pF)	5.03 (60pF)	ns
TR	Output Rising Time	2.26 (10pF)	4.45 (30pF)	7.83 (60pF)	ns
TF	Output falling Time	1.90 (10pF)	3.63 (30pF)	6.23 (60pF)	ns

Appendix B. Limited Warranty

QDT warrants your Metal USB Flash Disk against defects in material and workmanship for the life of the drive. The warranty is void in the case of misuse, accident, alteration, improper installation, misapplication or the result of unauthorized service or repair. The implied warranties of merchantability and fitness for a particular purpose, and all other warranties, expressed or implied, except as set forth in this warranty, shall not apply to the products delivered. In no event shall QDT be liable for any lost profits, lost savings or other incidental or consequential damages arising out of the use of, or inability to use, this product.

BEFORE RETURNING PRODUCT, A RETURN MATERIAL AUTHORIZATION (RMA) MUST BE OBTAINED FROM QDT.

Product shall be returned to QDT with shipping prepaid. If the product fails to conform based on customers' purchasing orders, QDT will reimburse customers for the transportation charges incurred.

- **Industrial 5-year Warranty**
- **Standard 3-year Warranty**